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High CO2absorption capacity by chemisorption at cations and anions in choline-based ionic liquids

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Abstract

© 2017 the Owner Societies. The effect of CO 2 absorption on the aromaticity and hydrogen bonding in ionic liquids is investigated. Five different ionic liquids with choline based cations and aprotic N-heterocyclic anions were synthesized. Purity and structures of the synthesized ionic liquids were characterized by 1 H and 13 C NMR spectroscopy. CO 2 capture performance was studied at 20 °C and 40 °C under three different pressures (1, 3, 6 bar). The IL [N 1,1,6,2OH][4-Triz] showed the highest CO 2 capture capacity (28.6 wt%, 1.57 mol of CO 2 per mol of the IL, 6.48 mol of CO 2 per kg of the ionic liquid) at 20 °C and 1 bar. The high CO 2 capture capacity of the [N 1,1,6,2OH][4-Triz] IL is due to the formation of carbonic acid (-OCO 2 H) together with carbamate by participation of the -OH group of the [N 1,1,6,2OH] + cation in the CO 2 capture process. The structure of the adduct formed by CO 2 reaction with the IL [N 1,1,6,2OH][4-Triz] was probed by using IR, 13 C NMR and 1 H- 13 C HMBC NMR experiments utilizing 13 C labeled CO 2 gas. 1 H and 13 C PFG NMR studies were performed before and after CO 2 absorption to explore the effect of cation-anion structures on the microscopic ion dynamics in ILs. The ionic mobility was significantly increased after CO 2 reaction due to lowering of aromaticity in the case of ILs with aromatic N-heterocyclic anions.

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